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Southwestern
Region

Forest Pest Management Report

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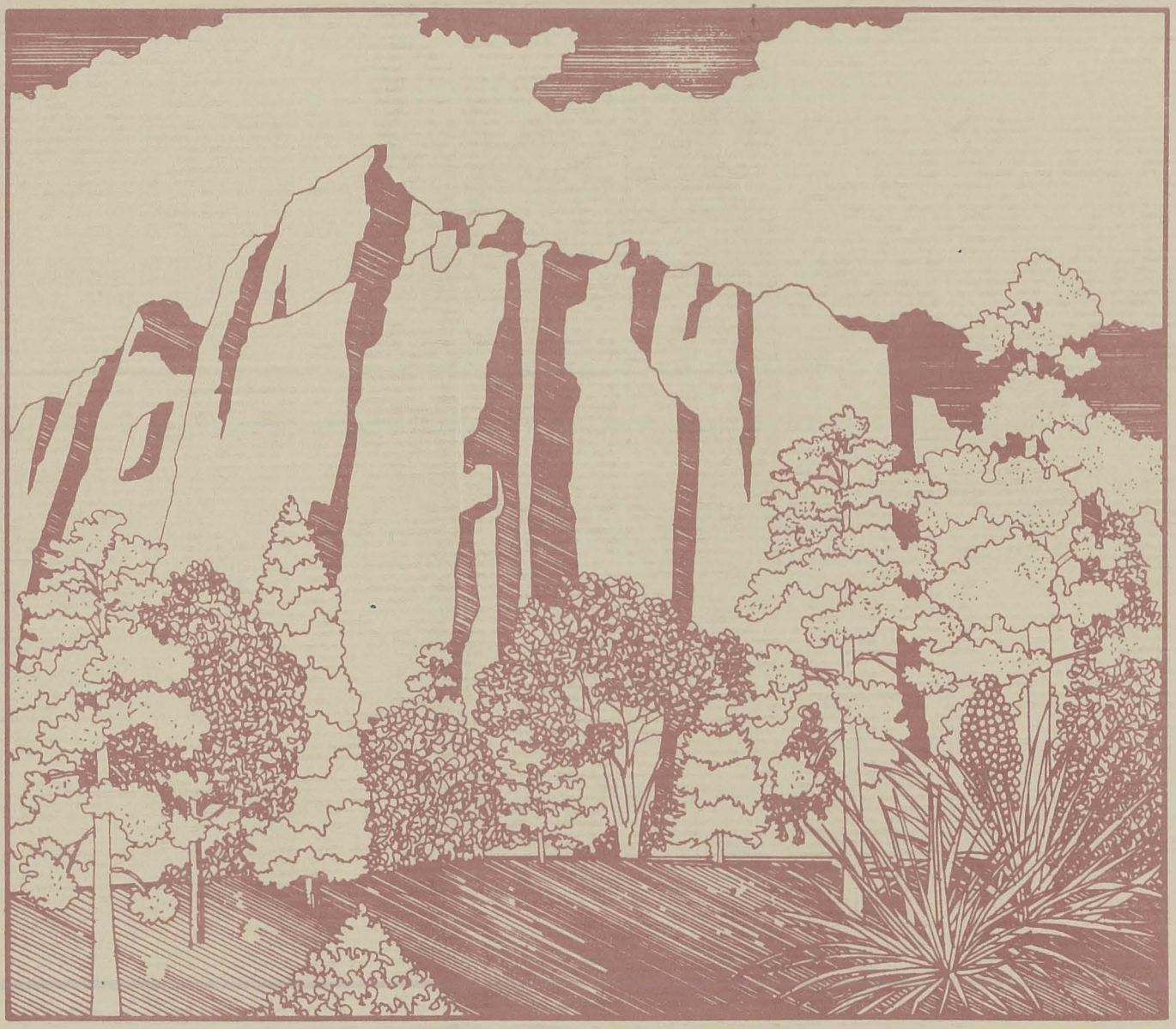
ANNUAL SOUTHWESTERN REGION
PEST CONDITIONS REPORT
1990

MAY 1991



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ANNUAL SOUTHWESTERN REGION PEST CONDITIONS REPORT 1990

MAY 1991

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FOREWARD

The status of major insects and diseases in Southwestern forests in 1990 is summarized in this report. Much of the information is based on aerial and ground surveys conducted by Forest Pest Management Specialists, Southwestern Region, and State Pest Management Specialists of the Division of Forestry, Arizona State Land Department, and the New Mexico Department of Agriculture. These surveys report short-term changes in pest activity as well as indicating long-term trends when compared to previous surveys.

As in the past, Forest Pest Management specialists have compiled the information for lands of all ownerships; if required, further information and additional copies of this publication are available upon request.

ACKNOWLEDGEMENTS

We thank Robert Cain, Extension Forest Entomologist, New Mexico State University Cooperative Extension Service; and Robert Celaya, Forest Pest Specialist, Arizona State Land Department, for their input to this report.

CONDITIONS IN BRIEF

Bark beetle activity in the Southwest increased over three-fold from 20,950 acres in 1989 to 66,350 acres in 1990. Below average precipitation levels in 1989 and 1990 predisposed the majority of these trees to bark beetle attack and colonization. In ponderosa pine forests, Ips engraver beetle activity continued to cause the majority of volume losses (1,001,800 cubic feet), followed by western pine beetle (376,950 cubic feet) and mountain pine beetle (80,500 cubic feet). Ips engraver beetles also caused an estimated 1,140,000 cubic feet of volume loss in the pinyon-juniper forests. In the mixed conifer and spruce forests, beetles attacking Douglas-fir and true fir attacks caused 76,500 and 101,900 cubic feet of volume loss respectively. The spruce beetle caused 11,500 cubic feet of volume loss.

Defoliator activity Regionwide increased nearly three-fold from 109,800 acres in 1989 to 314,250 acres in 1990. Most of this defoliation was due to the resurgence of the western spruce budworm which defoliated an estimated 310,580 acres of the mixed conifer forests. Aspen defoliation occurring from a combination of large aspen tortrix, western tent caterpillar, and Marssonina leaf blight decreased significantly from 19,075 acres in 1989 to 3,670 acres in 1990.

Dwarf mistletoes continued to be the major pest problem in the Region, causing growth loss and mortality in the ponderosa pine and mixed conifer forests. An estimated 38 percent of the commercial ponderosa pine acreage, and a higher percentage of the mixed conifer acreage, is infected. Annual volume loss may exceed 25 million cubic feet. As in 1989, heavy infection levels, combined with below normal precipitation, caused above average amounts of tree mortality throughout much of the Region, especially at lower elevations.

Root and butt rots are also important damaging agents in the Southwestern Region. The most common are armillaria root disease and annosus root disease. These occur in all the commercial timber types, but are usually more prevalent in the mixed conifer and spruce fir forests. Annual volume loss approaches 5 million cubic feet.

White pine blister rust was detected for the first time in the Region. It is currently limited to an area of approximately 80 square miles in the Sacramento Mountains of southern New Mexico. The disease appears to be very damaging to southwestern white pine.

STATUS OF MAJOR INSECTS

Douglas-fir beetle, Dendroctonus pseudotsugae

Douglas-fir beetle activity decreased significantly Regionwide from 3,360 acres in 1989 to 700 acres in 1990. Both individual and small group tree mortality (2 to 10 trees) occurred on the Apache-Sitgreaves and Coconino National Forests and Fort Apache and Navajo Indian Reservation lands, Arizona, and the Carson National Forest and Taos Pueblo Indian Reservation, New Mexico (Figure 1, Appendix). On State and private lands, 138 pockets of Douglas-fir beetle-killed trees were scattered throughout northern New Mexico with most of this mortality occurred in Colfax County. Losses resulting from Douglas-fir beetle attacks in 1990 approximated 76,500 cubic feet of volume Regionwide.

Mountain pine beetle, Dendroctonus ponderosae

Mountain pine beetle-caused ponderosa pine mortality decreased slightly from 900 acres in 1989 to 800 acres in 1990. Individual and scattered small group tree mortality (2 to 10 trees) were observed on the Kaibab National Forest, Grand Canyon National Park, and Navajo Indian Reservation, Arizona, and the Carson National Forest and Taos Pueblo Indian Reservation, New Mexico (Figure 2, Appendix). Volume losses resulting from these bark beetles were estimated at 80,500 cubic feet in the Southwest.

Pine engraver beetles, Ips spp.

Ponderosa pine mortality from pine engraver beetle attacks increased nearly three-fold from 11,050 acres in 1989 to 31,400 acres in 1990. The majority of these trees were predisposed to Ips beetle attack by the drought conditions experienced in 1989 and 1990. Individual, small group tree mortality (2 to 10 trees) and occasional large group tree mortality (25 trees and larger) occurred on the Apache-Sitgreaves, Coconino, Kaibab, Prescott, and Tonto National Forests and Navajo, Fort Apache, and San Carlos Apache Indian Reservations, Arizona, and the Cibola, Gila, Lincoln, and Santa Fe National Forests and Acoma, Mescalero Apache, and Santa Clara Indian Reservations, New Mexico (Figure 3, Appendix). Several large areas of ponderosa pine mortality were also detected on State and private lands along State Highway 260 between Heber and Linden, Arizona.

Large numbers of pinyon pine mortality were detected on approximately 23,800 acres of the Apache-Sitgreaves National Forests northwest of Heber, Arizona. Pinyon mortality was also widespread on State and private lands around Sedona and Williams, Arizona. Mortality was primarily drought-related followed by secondary Ips beetle colonization.

Tree volume losses from these bark beetles amounted to 1,001,800 cubic feet for ponderosa pine and 1,140,000 cubic feet for pinyon pine.

Western pine beetle, Dendroctonus brevicomis

Mortality from western pine beetle attacks increased over two-fold from 3,700 acres in 1989 to 9,000 acres in 1990. Again, most of these trees were predisposed to attack by below average precipitation levels experienced during 1989 and 1990. The majority of the mortality observed occurred on the

Apache-Sitgreaves National Forests (4,850 acres), Arizona, and the Gila (1,300 acres) National Forest, New Mexico. Less extensive western pine beetle-caused mortality occurred on the Coconino, Coronado, Kaibab, and Tonto National Forests and Navajo, Fort Apache, and San Carlos Indian Reservations, Arizona, and Gila National Forest, New Mexico (Figure 4, Appendix). Volume losses Regionwide were collectively estimated at 376,950 cubic feet.

Spruce beetle, Dendroctonus rufipennis

Spruce beetle-caused tree mortality decreased substantially from 780 acres in 1989 to 150 acres in 1990. Individual and small group tree mortality (2 to 5 trees) were widely scattered throughout the spruce forest cover type on the Coconino, Coronado, and Kaibab National Forests, Arizona, and Navajo and Fort Apache Indian Reservations, Arizona (Figure 5, Appendix). Although no spruce beetle activity was detected on Federal lands in New Mexico, approximately 80 acres of spruce mortality were reported on State and private lands in Sandoval and Colfax Counties. Estimated volume losses from spruce beetle attacks approximated 11,500 cubic feet.

Western spruce budworm, Choristoneura occidentalis

Western spruce budworm defoliation increased significantly throughout the Region, from 90,000 acres in 1989 to over 310,580 acres in 1990. The large majority of this defoliation occurred on the Kaibab (21,680 acres) National Forest and Grand Canyon (4000 acres) National Park, Arizona, and the Carson (131,280 acres) and Santa Fe (95,600 acres) National Forests, New Mexico. Less extensive areas of western spruce budworm defoliation also occurred on the Cibola (3,800 acres) and Gila (840 acres) National Forests, Picuris (200 acres), and Santa Clara (880 acres) Pueblo Indian Reservations, New Mexico (Figure 6, Appendix). Western spruce budworm defoliation damages on State and private lands in northern New Mexico exceeded 52,300 acres. Heaviest western spruce budworm defoliation occurred in Mora County north and west of Chacone bordering the Carson National Forest and in Colfax County in the Moreno Valley and Black Lakes area. Growth loss attributed to this defoliator was conservatively estimated at 2.2 million cubic feet of volume. Total acres defoliated by the western spruce budworm in 1990 are summarized by land ownership class in Table 1 below.

Table 1. Acres of Western Spruce Budworm Defoliation, Southwestern Region, 1990

Land Ownership Class	Defoliation (Acres) Light	Moderate	Heavy	Total
National Forest	41,600	117,680	93,920	253,200
Indian Lands	360	720	-	1,080
National Park Service	4,000	-	-	4,000
State and Private*	31,093	17,388	3,820	52,301
		GRAND TOTAL		310,581

* Intermingled State and private within and adjoining National Forests

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1990.

Insect	Host	Location	Remarks
Douglas-fir tussock moth *Orgyia pseudotsugata*	Douglas-fir White fir Spruce	New Mexico	Tussock moth defoliation damages increased in the communities of Santa Fe, Los Alamos, and White Rock where some top-killing and mortality of host trees were reported. Low levels of tussock moth activity were also reported in Espanola, Cedar Crest, Raton, and Ruidoso.
Fall webworm *Hyphantria cunea*	Siberian elms Cottonwoods	New Mexico	Fall webworm populations were at a higher level in northern New Mexico. Siberian elms and cottonwoods were heavily defoliated by these insects on the east side of the Sangre de Cristo Mountains.
Pandora moth *Coloradia pandora*	Ponderosa pine	Arizona	Larvae of the pandora moth caused light defoliation on 720 acres of the ponderosa pine forest cover type on the Grand Canyon National Park, Arizona, in 1989. Because this insect's two-year life cycle, defoliation is not expected to occur again until the spring and summer of 1991.
Pinyon needle miner *Coleotechnites edulicola*	Pinyon pine	New Mexico	Small pockets of pinyon needle miner damage were detected on woodland pinyons south and east of Santa Fe.
Pine tip moths *Rhyaciona* spp.	Ponderosa pine	New Mexico	Southwestern pine tip moth activity continued to cause extensive damage to ponderosa pine plantations in Chama. This tip moth also damaged some landscape pines in communities over 6,500 feet. Nantucket pine tip moth feeding activity seriously deformed young landscape pines in Albuquerque and southern New Mexico.
Pine sawflies *Zadiprion* spp. *Neodiprion* spp.	Ponderosa pine	New Mexico	Ponderosa pine sawfly defoliation increased noticeably in several northern New Mexico communities where defoliation damages were generally limited to a few branches on each tree. In Santa Fe, two mature pines were heavily defoliated by unusually high populations of *Z. townsendi*.

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1990 continued.

Insect	Host	Location	Remarks
Pinyon needle scale *Matsucoccus acalyptus*	Pinyon pine	Arizona New Mexico	Pinyon needle scale populations increased in pinyon woodlands and on ornamental pinyons Regionwide. In Arizona, a large infestation continued near Prescott. In New Mexico, new outbreaks detected include those found north of Carrizozo (300 acres) and south and east of Silver City (500 acres). A large pinyon pine needle infestation of unknown acreage was also reported southwest of Socorro. Pinyon needle scale defoliation also continued to occur between El Rito and Ojo Caliente in Rio Arriba County and 15 miles south of Willard in Torrance County. Damages to landscape pinyons in urban areas appeared to be up statewide.
Ponderosa pine needle miner *Coleotechnites ponderosae*	Ponderosa pine	New Mexico	Ponderosa pine needle miner damages were detected on 7,220 acres of State and private lands in Miguel County near Mineral Hill. Needle miner damages also continued to occur around Los Alamos.
Prescott Scale *Matsucoccus vexillorum*	Ponderosa pine	Arizona New Mexico	Flagging (branch and twig dieback) caused by Prescott scale infestations on ponderosa pine were scattered through out the Region in 1990. Approximately 74,000 acres of host type were infested on the Apache-Sitgreaves National Forests, Arizona. Some minor Prescott scale damage also occurred on the Prescott National Forest and neighboring private lands and San Carlos Indian Reservation, Arizona, and the Cibola and Gila National Forests and Jicarilla Apache Indian Reservation, New Mexico.
Twig beetles *Pityophthorus* spp.	Pinyon pine	New Mexico	*Pityophthorus* twig beetles caused scattered mortality over several thousand acres along State Highway 64 from Farmington east to the Rio Arriba County border. Several thousand acres of twig beetle-caused branch dieback were also observed on the Mescalero Apache Indian Reservation along State Highway 70 between Ruidoso and Mescalero.

Table 2. Status of Other Insects Occurring in Arisona and New Mexico in 1990 continued.

Insect	Host	Location	Remarks
Scarab beetle *Phyllophaga* spp.	Ponderosa pine	New Mexico	Defoliation from adult scarab beetle feeding activity was reported on about 210 acres of ponderosa pine in Mora County southeast of Ocate. Defoliation damages were heaviest on trees bordering rangeland where the immature beetle grubs feed.
Spruce aphid *Elatobium* sp.	Spruce	Arisona New Mexico	Spruce aphids defoliated the older foliage of spruce on approximately 100,000 acres of the Fort Apache Indian Reservation, Arizona. Some minor spruce aphid activity was also detected near Santa Fe, New Mexico, no significant defoliation damages were observed on the aphid infested trees.
PEST COMPLEXES			
Aspen defoliation			
Large aspen tortrix *Choristoneura conflictana* Western tent caterpillar *Malacosoma californicum* Marssonina blight *Marssonina populi*	Aspen	Arizona New Mexico	Defoliation of aspen stands by this insect and disease complex decreased significantly Regionwide from 19,075 acres in 1989 to 6,870 acres in 1990. Small pockets of aspen defoliation occurred on the Kaibab National Forest and Grand Canyon National Park in Arizona. In New Mexico, small pockets of aspen defoliation occurred on the Carson, Gila, and Santa Fe National Foreets, and Taos Pueblo Indian Reservation, New Mexico. In New Mexico, western tent caterpillar was found to be the primary defoliator on State and private lands east of Santa Fe, west of Guadalupita, west of Los Alamos, and west of Chama. Leaf rolling moths such as the large aspen tortrix may account for some of the aspen defoliation, but no significant populations were detected from the ground.

Table 2. Status of Other Insects Occurring in Arizona and New Mexico in 1990 continued.

Insect	Host	Location	Remarks
True Fir Mortality *Scolytus ventralis* (in white fir); *Dryocetes confusus* (in subalpine fir) *Armillaria* spp. *Heterobasidion annosum*	White Fir Subalpine fir	Arizona, New Mexico	True fir mortality resulting from this insect and disease complex increased slightly from 1,250 acres in 1989 to 1,400 acres in 1990. Mortality consisted of individual and small (2-10 trees) group tree-killing on the Apache-Sitgreaves, Coconino, Coronado, Kaibab, and Tonto National Forests and Navajo Indian Reservation, Arizona, and the Carson and Gila National Forests, and Taos Pueblo Indian Reservation, New Mexico. Volume losses attributed to this insect and disease complex approximated 101,900 cubic feet.

STATUS OF MAJOR DISEASES

Dwarf mistletoes, Arceuthobium spp.

Dwarf mistletoes are the most widespread and damaging pests in the Southwestern Region. Estimated annual volume loss is over 25 million cubic feet. In addition to growth loss, heavy infection results in reduced cone and seed production, and a reduction in seed viability. Tree decline and mortality caused by these parasites impacts aesthetic qualities at recreation sites and in visual corridors. There is concern that stand breakup may be affecting critical wildlife habitat in some parts of the Region by reducing available hiding and thermal cover.

The dwarf mistletoe species most impacting forests in Arizona and New Mexico are A. vaginatum subsp. cryptopodum on ponderosa pine, and A. douglassii on Douglas-fir. Both of these occur nearly throughout the ranges of their hosts in the Southwest. A. microcarpum on Englemann and blue spruce is very destructive where it occurs, but its range is quite limited. Pinyon pine is damaged in many parts of the Region by A. divaricatum. Other dwarf mistletoes occur in the Southwest, but generally have less impact than these four species.

Although dwarf mistletoes are a natural part of the forest ecosystem, having evolved with their coniferous hosts for tens of thousands of years, evidence suggests that their incidence has increased due to human activity. Surveys indicate a significant Regionwide increase in the last 30 years. The incidence of these pests may well have been much lower before man's impact on the forest that it is today.

Inappropriate cutting in infected stands has, in some instances, contributed to an increase in the incidence of these parasites. Perhaps even more significant is the suppression of natural wildfires, which were the primary factors controlling dwarf mistletoe in the past. The natural tendency of dwarf mistletoe is to spread, unless held in check be wildfire or appropriate cutting methods.

Increasing levels of dwarf mistletoe infection in the Region point out the need for and importance of well conceived efforts to control these parasites. Forest Pest Management provides both financial and technical assistance for projects designed to reduce the level of infection in established stands, to protect young regeneration from infection, and to replace some heavily infected stands. Projects designed to increase vigor and longevity of trees in recreation areas and visual corridors, and projects for wildlife habitat improvement are also encouraged.

True mistletoes, Phorodendron spp.

True mistletoes are generally less damaging than their dwarf counterparts because they manufacture much of their own food. However, there are many woodland areas in the National Forests, National Parks, and Indian Reservations of the Southwest that are significantly impacted by two species of true mistletoe on juniper: P. juniperinum and P. capitellatum. Heavily infected stands suffer significant growth loss and mortality, particularly during times of moisture stress.

Aspen stem canker and decay fungi

Aspen stands in Arizona and New Mexico are attacked by a number of stem cankering fungi including: Ceratocystis fimbriata, Hypoxylon mammatum, Encoelia pruinosa (syn. Cenangium singulare), Cytospora chrysosperma, and Cryptosphareria populina. Canker fungi cause significant losses in mature aspen stands, as a result of tree mortality, top breakage, cull, and degradation. In many of the Region's aspen stands, 30 percent or more of the stems are affected. In addition, aspen timber type suffers widespread losses to white trunk rot stem decay caused by the false tinder fungus, Phellinus tremulae. White trunk rot incidence is especially significant in mature aspen stands, and cull volumes may range as high as 50 to 60 percent of the total standing volume. The damage to aspen trees by canker and decay fungi is further increased in campgrounds, due to mechanical wounds incurred during campground establishment and injury from recreationists.

Root diseases

Root and butt rot pathogens are responsible for approximately 10 percent reduction in yield Regionwide. Infections in some mixed conifer stands is greater than 25 percent. Armillaria spp. account for 80 percent of the root disease damage in conifers, especially ponderosa pine. Other root pathogens include Fomes annosus, Phaeolus schweinitzii, and Inonotus tomentosus, the latter occurring on spruce. The Southwest looses an estimated 4.8 million cubic feet annually to root disease.

Beginning in 1989, root disease pockets were evaluated in the Big Lake Recreation Area, Springerville, Ranger District, Apache-Sitgreaves National Forests. The information will be used to guide placement of a proposed campground facility.

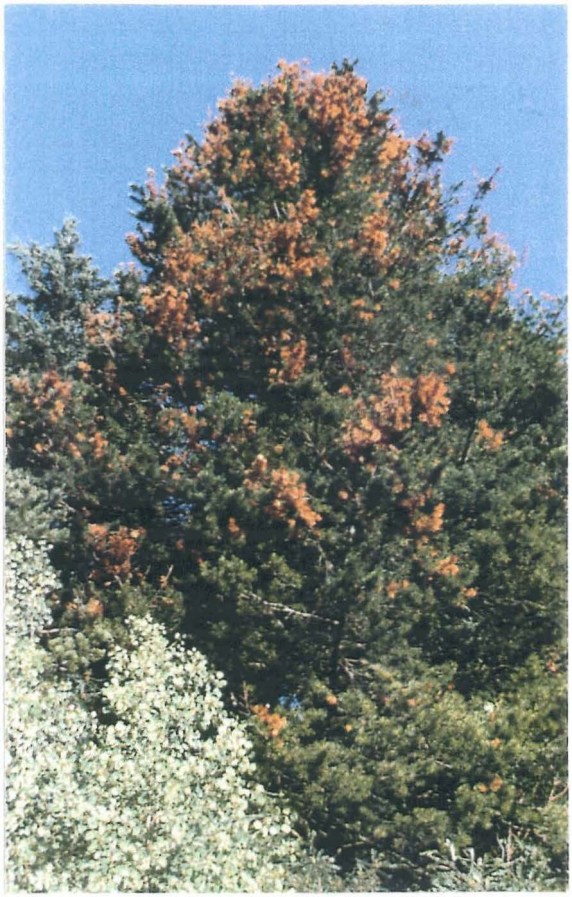
Lophodermella needle cast, Lophodermella cerina

Extensive areas of ponderosa pine of all ages were affected by this foliage disease, particularly in New Mexico. Regionwide, approximately 270,000 acres of the ponderosa pine forest cover type exhibited needle discoloration caused by this disease in 1990 (Figure 7, Appendix), compared to 111,000 acres reported in 1989.

White pine blister rust

This damaging, non-native stem disease was detected for the first time in the Region, in the Sacramento Mountains of southern New Mexico. This is the first report of this disease in natural stands of southwestern white pine (Pinus strobiformis.) Our surveys indicate that it is present throughout an area of at least 80 square miles on the Lincoln National Forest and adjacent Mescalero Apache Indian Reservation. The most severely infected area occurs about three miles northeast of the village of Cloudcroft. Branch mortality ("flagging") is abundant, and top-kill and mortality of young trees is occurring.

Blister rust is caused by the fungus Cronartium ribicola. This fungus requires two different host species to survive and complete its life cycle. One host is any white (5-needled) pine, and the other is a current or gooseberry bush, of the genus Ribes. The fungus was originally introduced to this country from infected white pine planting stock shipped from Europe about 1900.



"Flagging" caused by
numerous branch cankers

Fruiting canker on sapling

Infected Ribes leaves

The discovery of blister rust in southern New Mexico is surprising because the closest known populations of the fungus are 600 miles north in Wyoming and over 800 miles west in California. The outbreak may be a result of infected white pine planting stock, or perhaps it was brought in on infected cultivated Ribes. Another possibility is that of long-distance spore dispersal in the jet stream.

There is a good chance that the disease will spread to other parts of the Southwest in the next few years. In addition to Southwestern white pine, limber pine (P. flexilis) and bristlecone pine (P. aristata) are known to be susceptible. Forest personnel should be alert for branch "flagging," visible year round, and the characteristic white "blisters," which occur on infected stems and branches in early summer.

Forest Pest Management and the Lincoln National Forest are establishing permanent plots to monitor damage caused by the rust. Pruning trails will be done on the plots; branch pruning has been done in other parts of the West to prevent infection and to remove potentially lethal cankers. Genetic resistance has been found in other white pine species, and may eventually be found in the Southwest.

Atropellis canker, Atropellis sp.

This disease was observed in 1990 at several locations on the Lincoln National Forest. Although damage from this disease appears minimal, it is mentioned here because; (1) this may be the first report of this disease on Southwestern white pine, and (2) it can be confused with blister rust. Typically, it is causing mortality of younger, smaller diameter branches than blister rust.

Table 3. Southwestern Region--Status of Other Diseases in Arizona and New Mexico

Disease	Host	Location	Remarks
STEM AND BRANCH DISEASES			
Comandra blister rust *Cronartium comandrae*	Mondell pine, Ponderosa pine	Arizona	Comandra rust continued to spread on exotic mondell pines (*P. elderica*) in the Payson, Sedona, and Prescott areas. Infections on native ponderosa pine are rare.
Fir broom rust *Melampsorella caryophyllacearum*	True firs	Arizona New Mexico	Fir broom rust is widely distributed throughout the subalpine, corkbark, and white fir habitat types in the Southwest. Damages typically consist of top-kill and stem breakage.
Limb rust *Cronartium arizonicum* *Peridermium filamentosum*	Ponderosa pine	Arizona	Small group (2 to 3 trees) infections were detected on the Apache-Sitgreaves National Forests, Grand Canyon National Park and the Fort Apache Indian Reservation.
Red rot *Dichomitus squalens*	Ponderosa pine	Arizona New Mexico	Red rot decay is distributed throughout the Region and is the most common cause of decay in living ponderosa pine in the Southwest.
Red ring rot *Phellinus pini*	Douglas-fir Ponderosa pine Spruce True firs	Arizona New Mexico	*Phellinus pini*, indigenous to mature and overmature stands of pine and mixed conifers, was scattered in distribution and losses and damage were minimal in most stands. It has also been found in immature pine and mixed conifers in suppressed conditions.
Rust-red stringy rot *Echinodontium tinctorium*	White Fir	Arizona New Mexico	This fungus was scattered in mature and overmature stands of mixed conifers but caused insignificant losses.
Spruce broom rust *Chrysomyxa arctostaphyli*	Spruce	Arizona New Mexico	Spruce broom rust was scattered throughout the host type but was of little commercial significance.

Table 3. Southwestern Region--Status of Other Diseases in Arizona and New Mexico--Continued

Disease	Host	Location	Remarks
ROOT DISEASES			
Black stain root disease *Leptographium wageneri* var. *wageneri*	Pinyon pine	Arizona New Mexico	In addition to the root rot fungi listed above, root disease pockets caused by these organisms are small and scattered throughout the Region.
Schweinitzii butt rot *Phaeolus schweinitzii*	Douglas-fir True firs		
White mottled rot *Ganoderma applanatum*	Aspen		
FOLIAGE DISEASES			
Elytroderma disease *Elytroderma deformans*	Pinyon pine Ponderosa pine	Arizona New Mexico	Elytroderma disease was widely distributed but at low levels.
Rhabdocline needle cast *Rhabdocline pseudotsugae*	Douglas-fir	New Mexico	No new reports of this disease in 1990.
ABIOTIC			
Drought	Ponderosa pine Pinyon Juniper	Arizona New Mexico	Drought related tree damage was widespread, with the National Forests, National Parks, and Indian Reservations Arizona cypress in Arizona being most affected. Damage appeared as branch dieback and mortality to scattered individuals and groups. Damage was often associated with other pests, including mistletoes and *Ips* beetles.
Hail damage	Pinyon Juniper Cottonwood	New Mexico	Extensive hail damage occurred on the east side of the Sandia and Manzano Ranges in late July. Several hundred acres of pinyon-juniper woodlands near the villages of Edgewood and Punta were severely defoliated.
Salt damage	Ponderosa pine	New Mexico	Needle discoloration and some tree mortality occurred along high elevation highways in New Mexico. Damage was especially noticeable near Los Alamos.

FOREST PEST MANAGEMENT ACTIVITIES IN 1990

Training

One of this year's highlights was our Regionwide training session, "Management of Forest Pests Through Silviculture" in Springerville, Arizona in September. Staff members from both the Arizona and New Mexico Zones gave presentations on insect and disease pests of the Southwest, with emphasis on biology and control. A panel discussion featured speakers from Timber, Wildlife, Forest Planning, and other disciplines. Field trips gave participants opportunities for group interaction and application of ideas. The session was well attended and well received. A similar session will be held in Taos in September 1991. A session designed specifically for the management of pests in recreation areas will be held in Flagstaff in April 1991.

Aerial detection surveys

On over 9.4 million acres of Federal lands in Arizona and New Mexico were surveyed from July thru mid September. Forest Pest Management surveys nearly all commercial timber acreage in the Region annually. Other areas, including pinyon-juniper woodlands, are flown on request. Ground examinations are often made to confirm aerial observations. Upon completion of the surveys, maps showing the type, location, and extent of outbreaks are prepared and sent to the respective administrative units. Aerial surveys are an effective way to detect activity of several major forest pests. Done annually, they provide an excellent way to monitor changes in pest activity over time. State pest management specialists conduct aerial and ground surveys on State and private lands.

Detection kits

A wide variety of insects and diseases were identified by our staff from surveillance reports sent by forest workers from across the Region. Such reports are important for the early detection of potential pest problems, and land managers and forest workers are encouraged to continue prompt reporting of any unusual insect and disease activity. Detection kits containing vials and bags for specimens, along with a surveillance work sheet, are provided by Forest Pest Management.

Integrated resource management

Forest Pest Management specialists provided expertise and assistance to interdisciplinary planning teams throughout the Region. In Arizona, Forest Pest Management consultants worked on a number of projects, primarily timber sales, on the Apache-Sitgreaves, Coconino, Kaibab, and Tonto National Forests. In these projects Forest Pest Management consultants assisted interdisciplinary team members in evaluating insect and disease conditions within planning areas and assessing how those conditions may affect accomplishment of future management objectives.

Snag recruitment

Two snag recruitment projects have been recently completed by the Luna Ranger District of the Gila National Forest. These projects were part of Forest Pest Management-funded dwarf mistletoe control projects. The projects were designed

both to meet wildlife needs and to reduce the intensification of dwarf mistletoe. Many of the snags were created using intense basal fires as a girdling tool. Results so far indicate that burning causes mortality more quickly than mechanical girdling. The burning method may also reduce the chance of stem breakage, which sometimes occurs when trees are girdled using a chainsaw. Monitoring of the projects for snag longevity and wildlife use will continue for several years.

Other wildlife habitat projects

Projects designed to improve wildlife habitat by controlling dwarf mistletoe are scheduled on the Carson and Lincoln National Forests in 1991. The emphasis of the projects is on the protection of young ponderosa pine regeneration from dwarf mistletoe infection. This should promote long-term hiding and thermal cover. Project areas are located within the Valle Vidal Unit of the Carson National Forest, an important elk habitat, and on the "westside" of the Cloudcroft Ranger District, Lincoln National Forest, a critical deer winter range.

Aspen regeneration

Permanent plots were established in the fall of 1990 to monitor the health of aspen regeneration in 10 stands located on the Coconino National Forest. The stands had been clearcut and fenced 0 to 10 years ago and ranged between 5 to 40 acres in size. All stands had small areas (1 to 3 acres) of repeated dieback or deficient sprouting. Data will be recorded and analyzed at 5 year intervals.

Dwarf mistletoe interpretive trail

A dwarf mistletoe interpretive trail was completed by the Kaibab National Forest with the assistance of Forest Pest Management near Grandview Lookout on the Tusayan Ranger District. The short trail follows the path of the Arizona trail as it heads south from the Grand Canyon. Signs along the trail describe dwarf mistletoe biology, prevention and control. Small demonstration areas showing thinning and pruning treatments are also present.

Campground development and root disease

The Arizona Zone Office of Forest Pest Management Specialists conducted a survey of 275 acres, delineated into 5 stands, in the Big Lake Management Complex on the Springerville Ranger District, Apache-Sitgreaves National Forests. Survey objectives were to determine distribution of insects and diseases and to use the information to recommend a location for a proposed campground facility. Pests observed in the survey that could affect campground longevity and hazard tree development were: Root rots, dwarf mistletoes, stem decays, and aspen stem cankers. Each stand was unique in occurrence and level of these diseases. An area in which the diseases can either be avoided or managed effectively was selected with District personnel for location of the proposed campground.

Burning dwarf mistletoe infected overstory tree for "snag recruitment"

Dichomitus squalens, the cause of red rot on ponderosa pine branch

Table 4. Dwarf Mistletoe Presuppression Surveys and Suppression Projects Conducted During 1990 on National Forest and Bureau of Indian Affairs Trust Lands.

Federal Agency	Presuppression Survey Acres	Suppression Project Acres
National Forest		
Carson	6,500	
Cibola		23
Coconino	3,036	551
Gila		126
Kaibab	3,208	15
Lincoln	35,000	
Santa fe	20,000	100
Tonto	10,000	5,000
Reservation		
Acoma	700	
Fort Apache	57,000	576
Jicarilla	13,000	240
Mescalero		629
San Carlos		325
Santa Clara	1,500	106
TOTALS	149,944	7,691

BIOLOGICAL EVALUATIONS COMPLETED IN 1990

Arizona Zone

1. Alder dieback, Alpine Ranger District, Apache-Sitgreaves National Forests, Arizona. 1/8/90.

2. Fairweather, Mary Lou. Pest conditions and potential hazard trees in selected campgrounds on the Bradshaw Ranger District, Prescott National Forest, Arizona. March 1990. R-3 90-1.

3. Wilson, Jill L. and Mary Lou Fairweather. Pest conditions and potential hazard trees in three campgrounds on the Verde Ranger District, Prescott National Forest, Arizona. March 1990. R-3 90-2.

4. Fairweather, Mary Lou. Pest conditions and potential hazard trees in two campgrounds on the Kaibab National Forest, Arizona. March 1990. R-3 90-3.

5. Fairweather, Mary Lou and Jill L. Wilson. Pest conditions and potential hazard trees in selected campgrounds on the Coconino National Forest, Arizona. March 1990. R-3 90-4.

6. Fairweather, Mary Lou. Pest conditions and potential hazard trees in selected campgrounds on the Tonto National Forest, Arizona. March 1990. R-3 90-5.

7. Ips infestations in burns at Red Hill, Peaks Ranger District, Coconino National Forest, Arizona. 5/21/90.

8. Functional assistance trip to the San Carlos Indian Reservation, Arizona. 5/22/90.

9. Annual southwestern region pest conditions report. June, R-3 90-9.

10. Old Summit I dwarf mistletoe project, San Carlos Indian Reservation, Arizona. 8/13/90.

11. Old Summit II dwarf mistletoe project, San Carlos Indian Reservation, Arizona. 9/4/90.

12. Functional assistance trip to Canyon de Chelly National Monument, Arizona. 9/4/90.

13. Functional assistance trip to Fort Apache Indian Reservation, Arizona. 9/26/90.

14. Functional assistance trip to Hubell Trading Post National Historic Site, Arizona. 9/4/90.

15. Followup visit to Dude Fire. 12/4/90.

New Mexico Zone

1. Diener dwarf mistletoe suppression project, Mount Taylor Ranger District, Cibola National Forest, New Mexico. 10/3/89.

2. Las Vacas Mesa insect and disease survey. Cuba Ranger District, Santa Fe National Forest, New Mexico. 12/5/89.

3. Rogers, Terrence J. Pest conditions and potential hazard trees occurring at the Canjilon Lakes Recreation Area, Canjilon Lakes Ranger District, Carson National Forest. March 1990. R-3 90-6.

4. Barillas dwarf mistletoe control project, Pecos Ranger District, Santa Fe National Forest, New Mexico. 3/1/90.

5. Hogback dwarf mistletoe control project, Cuba Ranger District, Santa Fe National Forest, New Mexico. 3/20/90.

6. Rogers, Terrence J. Pest conditions and potential hazard trees in nine selected campgrounds on the Camino Real and Questa Ranger Districts, Carson National Forest, New Mexico, April 1990. R-3 90-7.

7. Rogers, Terrence J. Pest conditions and potential hazard trees in selected recreation sites on the Smokey Bear Ranger District, Lincoln National Forest, New Mexico. May 1990. R-3 90-8.

8. Rogers, Terrence J. Pest conditions and potential hazard trees in four selected recreation sites on the Santa Fe National Forest. May 1990. R-3 90-10

9. Ips beetles in the Bear Springs timber sale area, Jemez Pueblo Indian Reservation, New Mexico. 5/2/90.

10. Coral Plantation dwarf mistletoe suppression project, Mount Taylor Ranger District, Cibola National Forest. 5/10/90.

11. Ips beetles in the Forest unit area, Zuni Pueblo Indian Reservation, New Mexico. 5/22/90.

12. Pest occurrence on the Mount Taylor Ranger District, Cibola National Forest, New Mexico. 6/5/90.

13. Discolored pines and western spruce budworm in high-use recreation sites. Carson National Forest, New Mexico. 6/25/90.

14. Tree damages on the Mescalero Apache Indian Reservation. 6/28/90.

15. New Mexico fir looper, western spruce budworm, and western pine beetle. Lincoln National Forest, New Mexico. 6/28/90.

16. Insect and disease evaluation of the proposed Trestle Bridge Picnic Area. Cloudcroft Ranger District, Lincoln National Forest, New Mexico. 7/26/90.

17. Hazard tree survey, Mescalero Apache Indian Reservation. 7/30/90.

18. Western spruce budworm/mountain pine beetle survey. Carson National Forest, New Mexico. 8/2/90.

19. Western pine beetle activity at the Tadpole, Scott Peak, and Farm Flat-2 Timber sale areas, Silver City Ranger District, Gila National Forest, New Mexico. 8/10/90.

20. Western spruce budworm egg mass survey, Camino Real Ranger District, Carson National Forest. 10/4/90.

21. Dwarf mistletoe project, Camino Real Ranger District, Carson National Forest. 9/10/90.

22. Pounds mesa dwarf mistletoe project, Jicarilla Apache Indian Reservation, New Mexico. 10/9/90.

23. Ponderosa pine mortality, Cerro Alta, Ramah Navajo Indian Reservation, New Mexico. 10/9/90.

24. Whitetail I and II dwarf mistletoe project, Mescalero Apache Indian Reservation, New Mexico. 10/9/90.

25. Deer pond dwarf mistletoe control project, Santa Clara Indian Reservation, New Mexico. 10/11/90.

26. Black mountain mistletoe project, Ramah Navajo Indian Reservation, New Mexico. 10/11/90.

27. West side dwarf mistletoe control project, Cloudcroft Ranger District, Lincoln National Forest, New Mexico. 10/22/90

28. Valle Vidal dwarf mistletoe control project, Questa Ranger District, Carson National Forest, New Mexico. 12/4/90.

29. Fence canyon root disease survey, Mescalero Apache Indian Reservation, New Mexico. 12/5/90.

30. Post-treatment evaluation, Apache summit dwarf mistletoe project, Mescalero Apache Indian Reservation, New Mexico. 12/18/90.

31. Post-treatment evaluation, whitetail I project, Mescalero Apache Indian Reservation, New Mexico. 12/19/90.

32. Rogers, Terrence J. Potential hazard tree and pest conditions occurring at the Nambe Falls recreation area, Nambe Pueblo Indian Reservation, New Mexico. December 1990.

PUBLICATIONS

1. Cain, Robert, Jesus Cota, and Charles Ward. 1990. Conifer pests in New Mexico. USDA Forest Service, Southwestern Region. 48 pp.

2. Fairweather, Mary Lou. 1990. Dwarf mistletoe infection in ponderosa pine. USDA Forest Service, Southwestern Region.

3) Wilson, Jill. 1990. Engraver beetles in southwestern pines. USDA Forest Service. Southwestern Region.

APPENDIX

FIGURE 1. Areas with widely scattered Douglass-Fir Beetle caused tree mortality in Region 3 during 1990 as observed during aerial detection surveys.

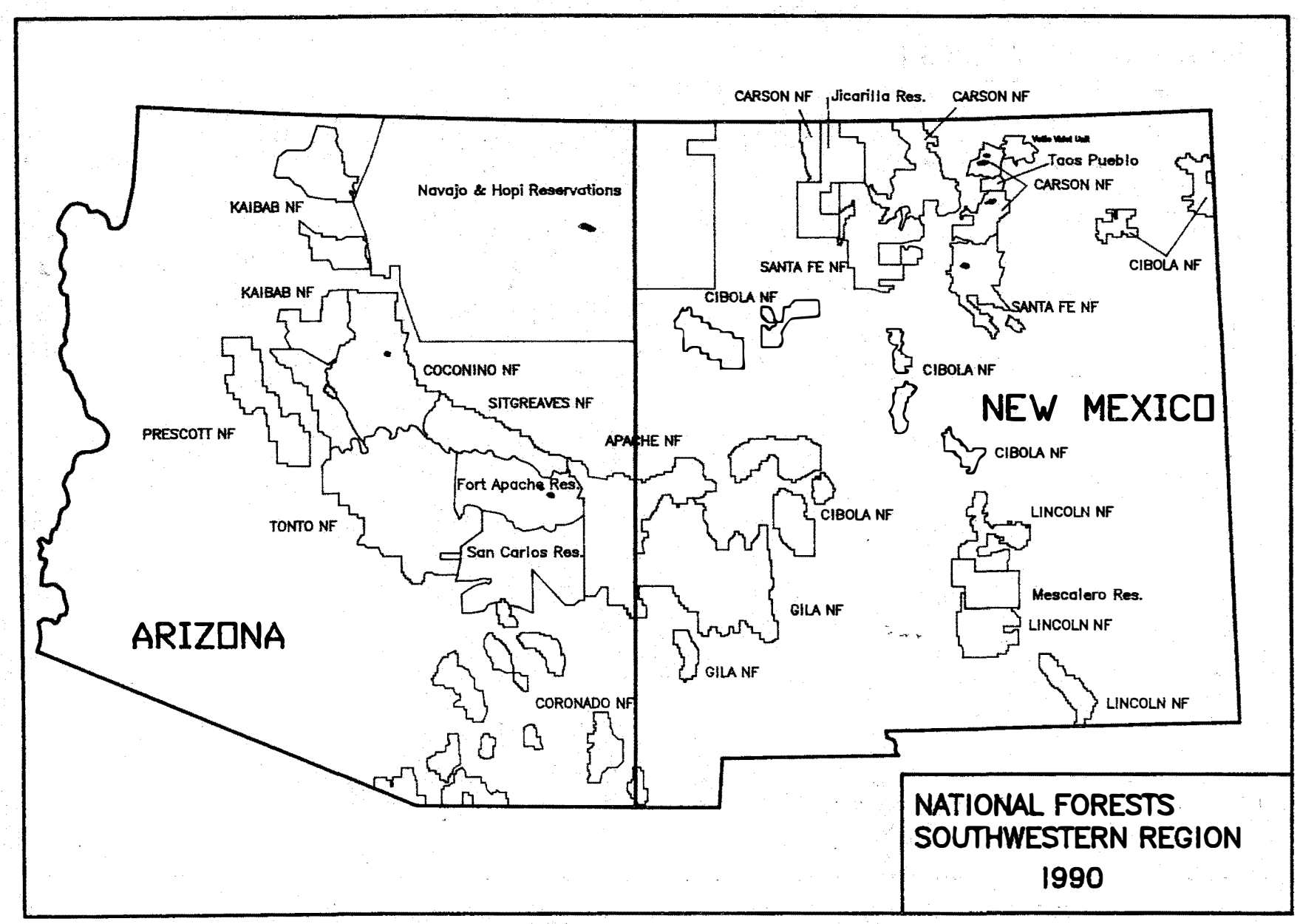


FIGURE 2. Areas with widely scattered Mountain Pine Beetle caused tree mortality in Region 3 during 1990 as observed during aerial detection surveys.

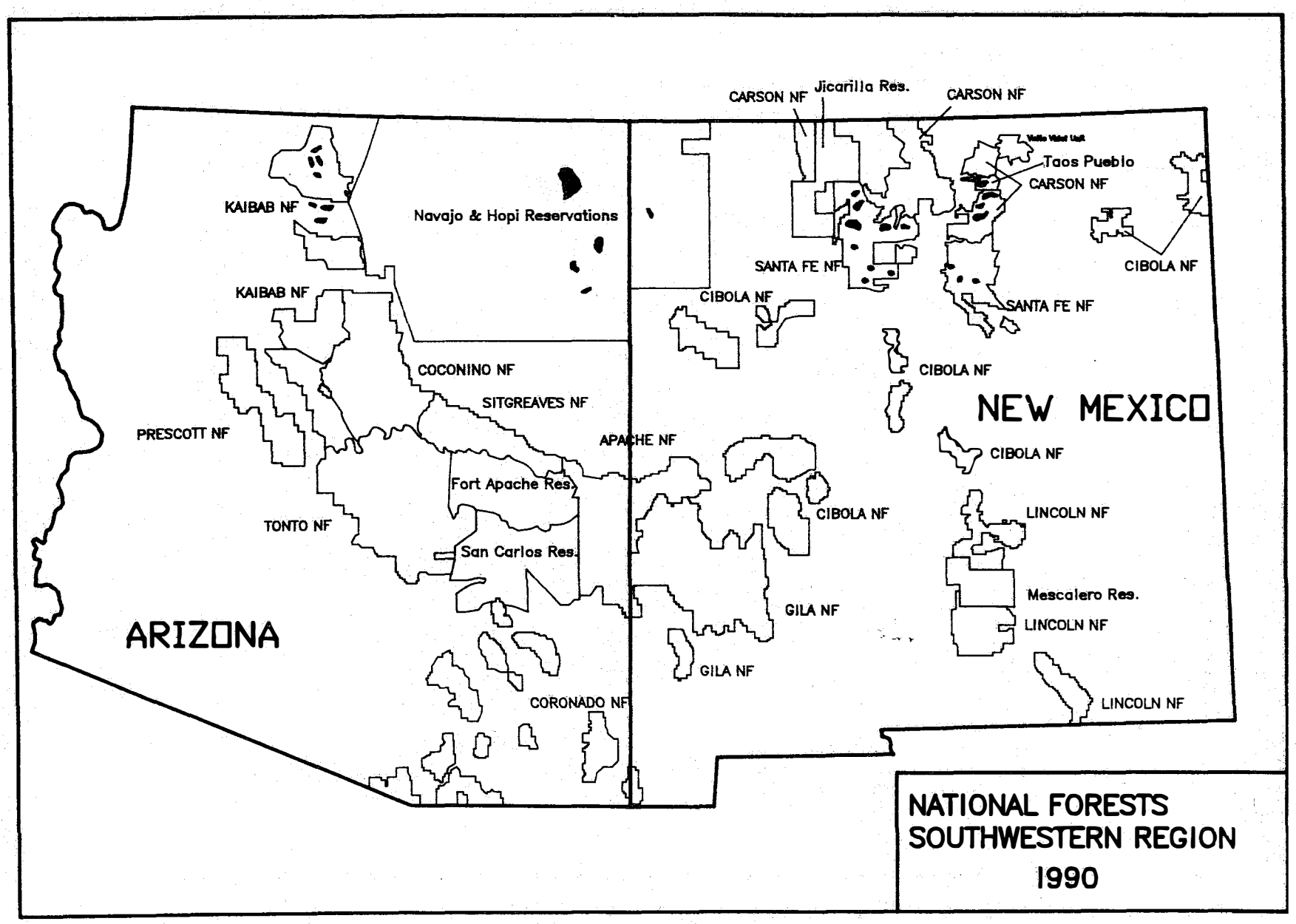


FIGURE 3. Areas with widely scattered Pine Engraver Beetle caused tree mortality in Region 3 during 1990 as observed during aerial detection surveys.

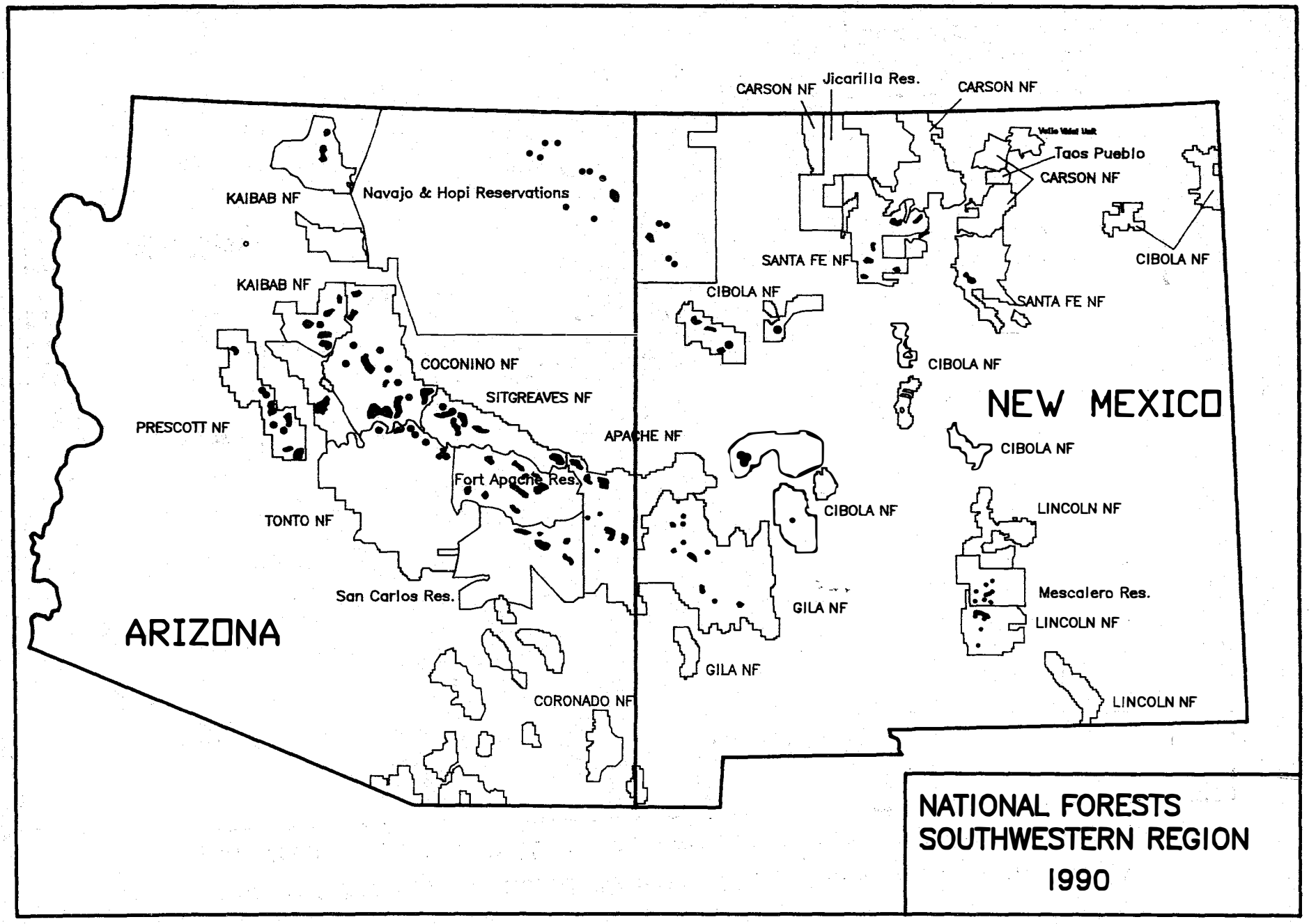


FIGURE 4. Areas with widely scattered Western Pine Beetle caused tree mortality in Region 3 during 1990 as observed during aerial detection surveys.

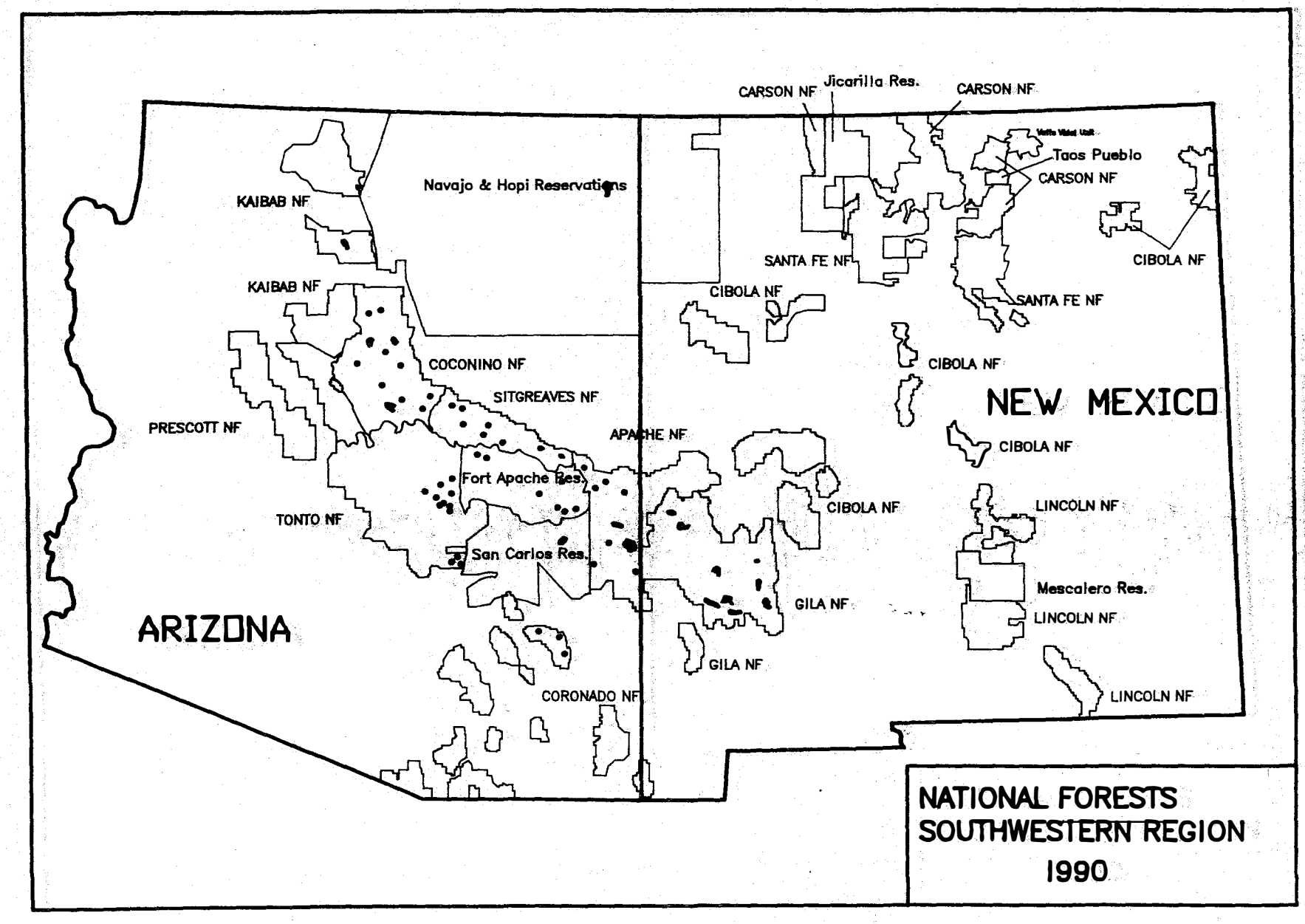


FIGURE 5. Areas with widely scattered Spruce Beetle caused tree mortality in Region 3 during 1990 as observed during aerial detection surveys.

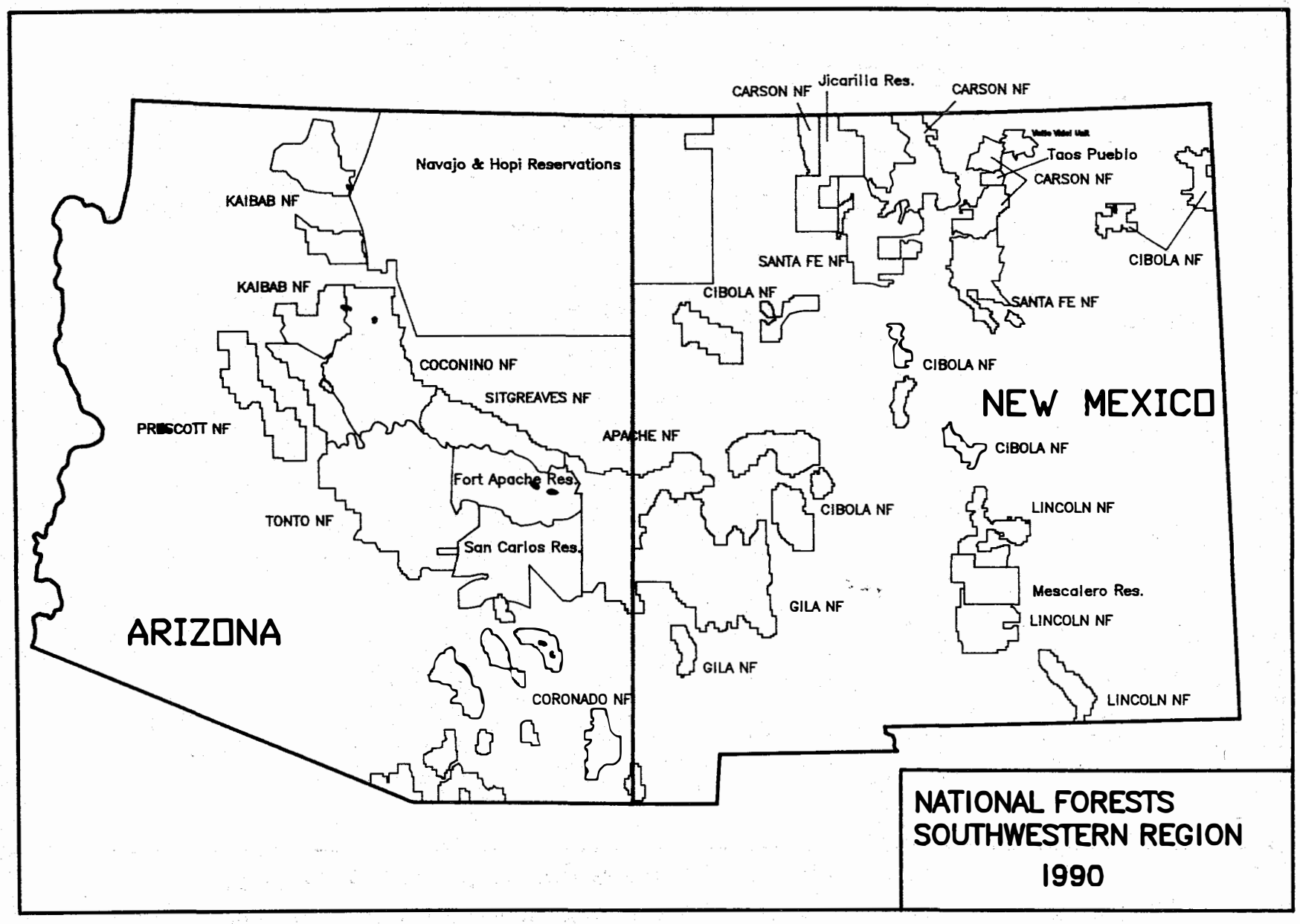


FIGURE 6. Areas infested by Western Spruce Budworm in Region 3 during 1990 as observed during Aerial Detection Surveys.

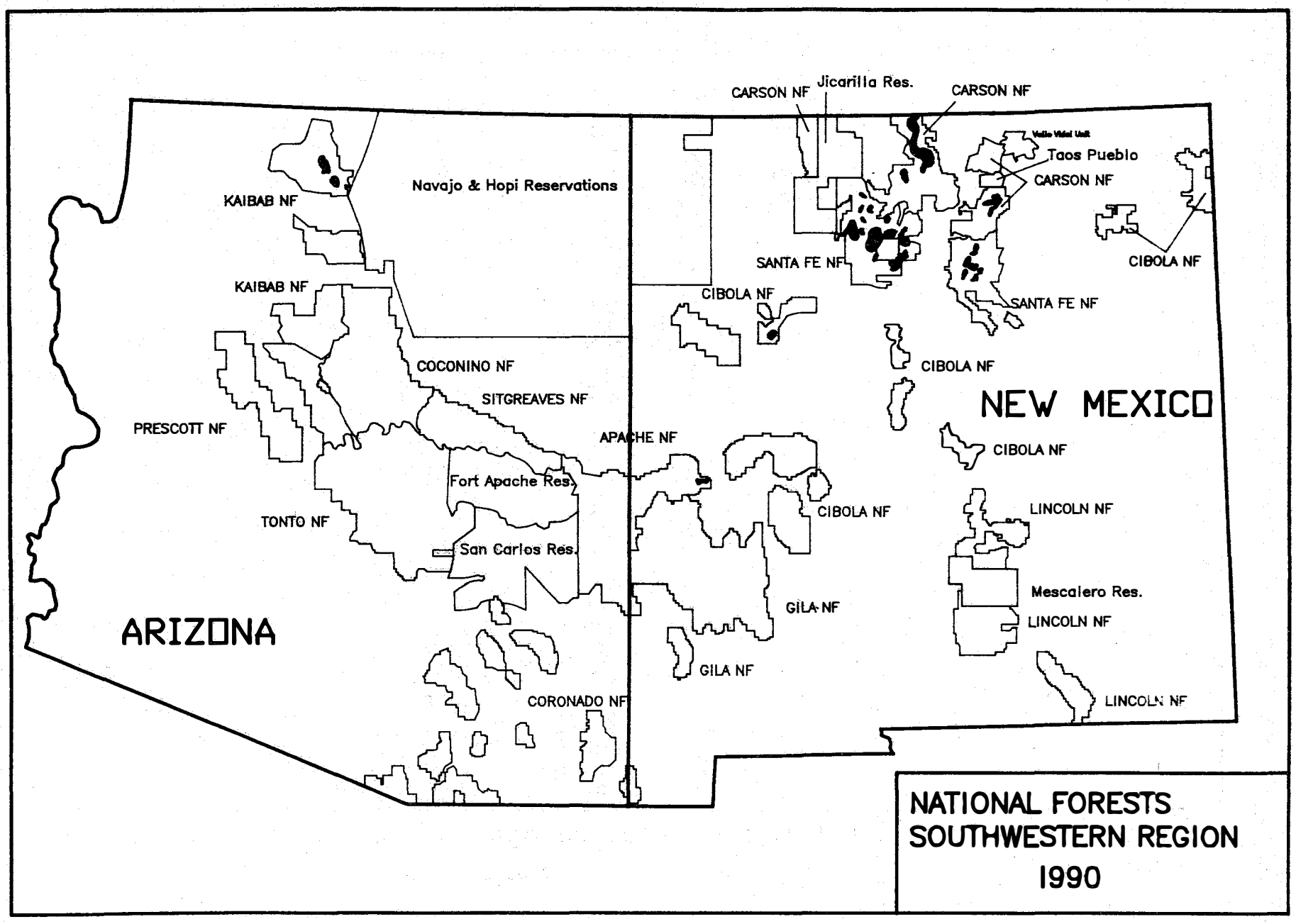


FIGURE 7. Areas infected with Lophodermella Needle Cast Disease in Region 3 during 1990 as observed during Aerial Detection Surveys.